3R AMI & 3R mAMI

Manual

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3R Technics GmbH
Technoparkstrasse 1
CH - 8005 Zürich

Phone: 0041 – 44 – 445 13 13
E-mail: info@3r-technics.com

Operating manual
3R AMI & 3R mAMI

Software version V.5.3.1.46

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Product overview

3R TQC

3R TQC Standard – the software comprises a complex mathematical model and therefore high accuracy and stability is secured. It is possible to measure 6 or even more target values at the same time. The measurement hardware is automatically controlled.

3R TQC Standard T – the software comprises a complex mathematical model and therefore high accuracy and stability is secured. It is possible to measure 6 or even more target values at the same time. This software is independent from hardware due to loading data from a text file, and therefore usable for optional target values computation.

3R TQC Basic – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of one target value. The measurement hardware is operated automatically.

3R TQC Basic 2Z – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of two target values. The measurement hardware is operated automatically.

3R TQC Basic 6Z – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of six target values. The measurement hardware is operated automatically.

3R TQC Basic T – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of one target value. This software is independent from hardware due to loading data from a text file, and therefore usable for optional target values computation.

3R TQC Basic 2Z-T – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of two target values. This software is independent from hardware due to loading data from a text file, and therefore usable for optional target values computation.

3R TQC Basic 6Z-T – the software comprises a simplified mathematical model. Less number of calibration samples is its advantage. It is designed for measurement of six target values. This software is independent from hardware due to loading data from a text file, and therefore usable for optional target values computation.

Special

3R mTQC is superior program allowing parallel control and evaluation of more measurements.

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Introduction

The 3R AMI software (3R AUTOMATIC MATERIAL IDENTIFICATION) enables non-destructive material identification and sorting. The installation and the operation of the 3R AMI software for the identification of materials based on the eddy-current values are described in this manual. The eddy-current values are measured with a MAGNATEST D SGP (software version 1.8 or higher) eddy-current device from Institute Dr. Foerster. The settings of the eddy-current device are adjusted at the device as usual. The 3R AMI software performs the selection of the test definition, the coil adjustment, the initiation of the measurement and the identification of the material, as well as other useful/practical functions. The 3R AMI software can be installed on a Windows XP® computer and communicates with the MAGNATEST D device via TCP/IP. It can also be installed directly on the MAGNATEST D device and communicate via *local host* with the software of the eddy-current device. Before the material identification is possible, a calibration process has to be done. The calibration must be done for each dimension, for example by sheet metal for each thickness, by round materials for each diameter and by pipes also for each wall thickness. By more complex geometries the calibration must be done for each part of the geometry or for each measuring point.

The 3R AMI software works with up to 24 frequencies including the harmonics evaluation.

3R mAMI

3R mAMI software enables multitasking with more 3R AMI systems. Thus it enables measurement with several coils or several measuring devices at the same time, central control, configuration and administration of individual measuring devices. This software enables measurement on several lines or several machines at the same time and coordination of these measurements from the same place. The operation of 3R mAMI software is the same like the operation of 3R AMI software only with a few differences. The differences in operation are described in following chapters: “Division of commands and actions”, “TCP/IP-connection – during the first start of 3R mAMI”, “Change of the TCP/IP configuration – 3R mAMI”, “TCP/IP Connection” and “Deliverance of the measured data”. The operation not described in these chapters corresponds with the operation of 3R AMI software with one exception - namely remote operation. When operating 3R mAMI software, the commands are sent to the 3R AMI software which acts as if being operated directly.

During the operation the distinction between actions that can be carried out simultaneously on several measuring devices and those that have to be done separately must be made. The settings in the main menu must be carried out

accordingly (see Figure 1). If the circlet on the upper right side is activated (a green dot inside), the commands will be sent to all measuring devices. In case it is not activated, the measuring device to which the orders should be sent must be selected from the pull-down menu in the upper right corner.

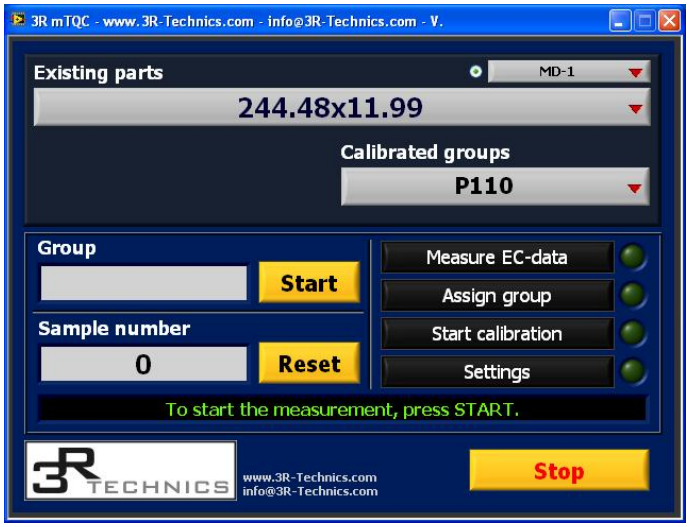

Figure 1: main window for 3R mTQC

Division of commands and actions

Simultaneously

Measure EC-data

Step 4 - Application of the 3R AMI software - identification of the groups/materials

Separately

Assign group

Read EC-data

Start calibration

Settings

Commands and actions will be explained further.

The communication between 3R AMI and 3R mAMI is possible only after being set properly. The settings description can be found in the chapters “TCP/IP-

connection – during the first start of the 3R mAMI" and "TCP/IP Connection". 3R mAMI software is an extension of 3R AMI and cannot be used separately.

Utilization procedure

1. Acquisition of the eddy-current data
2. Assignment of the groups/materials
3. Calibration of the 3R AMI software
4. Application of the 3R AMI software - identification of groups/materials

Data structure

Part or product (e.g. pipe dimension) >>> group (e.g. steel grade) >>> sample (e.g. no.1, no.2, no.3)

Procedure

Select/Enter a part >>> measure the samples (eddy-current values) >>> assign the correct groups to the samples (this can be done after all samples were measured) >>> start the calibration process (training of the mathematical model) >>> use the eddy-current system to separate the groups (measure the eddy-current data of a part/product, then the 3R AMI software will calculate which group it belongs to).

Syntax

Areas in the text highlighted by <<XYZ>> denote buttons in the program that can be seen in the associated figure.

Italic and underlined text denotes pure display elements that can be seen in the associated figure or data identifiers.

Installation

The installation window is opened by double clicking *setup.exe* (see Figure 2).

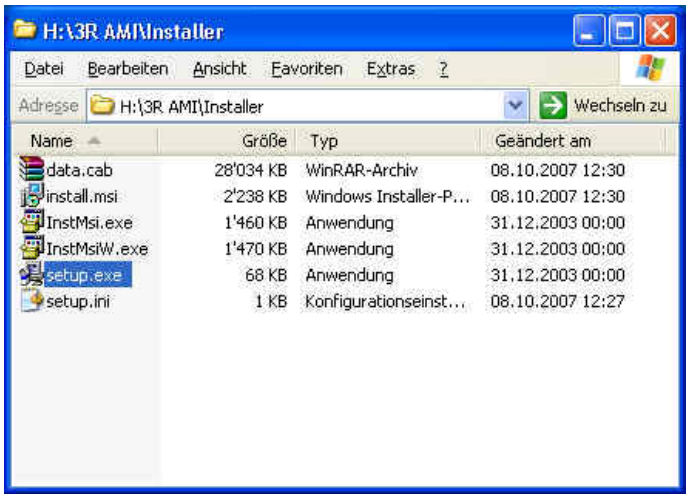
H:\3R AMI\Installer
Datei Bearbeiten Ansicht Favoriten Extras ?
Adresse H:\3R AMI\Installer
Wechseln zu
Name Größe Typ Geändert am
data.cab 28'034 KB WinRAR-Archiv 08.10.2007 12:30
install.msi 2'238 KB Windows Installer-P... 08.10.2007 12:30
InstMsi.exe 1'460 KB Anwendung 31.12.2003 00:00
InstMsiW.exe 1'470 KB Anwendung 31.12.2003 00:00
setup.exe 68 KB Anwendung 31.12.2003 00:00
setup.ini 1 KB Konfigurationseinst... 08.10.2007 12:27

Figure 2: installation files

After starting the installation window, the instructions of the installation wizard follow.

First steps

On the program start a menu window with the possibility to change the language will appear. This window will show up only for the first time the program is started, but in the menu <<Settings>> the language can be changed also later.

Figure 3: language change

In the following window the registration of the software can be started. Without the registration the program can be used for 30 days.

Figure 4: registration possibility

After the registration, this window will not appear any more and the software can be used on one computer for an unlimited period of time.

TCP/IP-connection – during the first start of the 3R AMI

In the next menu window the TCP/IP-connection settings for 3R AMI can be configured. This window appears after pressing the <<next>> button or after the registration.

Figure 5: Configuration of the IP-Address

In order to ensure the communication between the PC on which the 3R AMI software was installed and the eddy-current device, the correct IP address of the eddy-current device must be entered (see Figure 5). If the 3R AMI software was installed directly on the MAGNATEST D SGP device, the localhost address must be entered or the <<Localhost>> button must be pressed (see Figure 6). This

window shows up at the first start of the software or after loading the access code (see below). The IP address can be changed later in the menu <<Settings>> <<Change IP-address>>.

The computer and the eddy-current device must be connected through a network cable and a switch (small local network, see Figure 7) or through a company network.

Figure 6: configuration of the localhost address

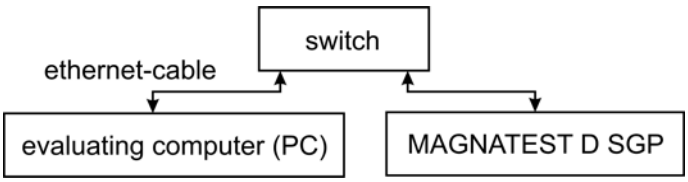

Figure 7: small local network

TCP/IP-connection – during the first start of the 3R mTQC

In the next menu window the TCP/IP-connection settings for 3R mAMI can be configured (see Figure 8). This window appears after pressing the <<next>> button or after the registration.

The name of the measuring device is entered into the table with the white background. If you e.g. have 3 measuring devices you want to measure with simultaneously with the help of 3R mAMI, it is possible to assign each of them a name, e.g. Device 1, Device 2, etc. At the same time the IP-address and the port number must be entered. It is also necessary to define the disc or disc partition where the 3R Technics directory is stored. The 3R Technics directory is always located on the same disc or disc partition along with Windows® operating system. This disc or disc partition must be accessible for 3R mAMI software

since 3R AMI software and 3R mAMI software share the data and directories of the 3R AMI software that are on the measuring device. Name, IP-Address, Port and disc must be entered and confirmed by pressing the <<Add>> button for each measuring device individually. After the confirmation the setting will appear in the table with the grey background. The measuring device settings can be deleted by selecting the device's name in the pull-down menu and pressing the <<Delete>> button (see Figure 9). All changes must be confirmed by pressing the <<Accept>> button. Work in this window is done by pressing the <<Finished>> button.

Figure 8: configuration of the TCP/IP-connection

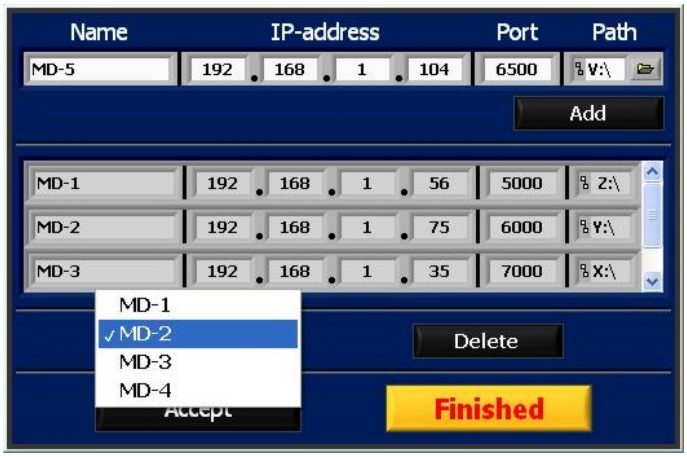

Figure 9: configuration of the TCP/IP-connection – delete the measuring device

Access code

At the first start of the program the registration window will appear via which a computer-dependent license <<Save license number>> (as a 3RT file) can be stored in a user-defined place on the computer. After sending it by email to 3R Technics - info@3r-technics.com (see Figure 10) the access code will be immediately generated and returned.

Figure 10: the license number saving

If the button <<next>> is pressed without loading the access code, the program can be used for 30 days. After 30 days the program will not work any more. The warning shown in Figure 4, from which the registration window can be accessed, will show up at every program start. As soon as the access code in the file "*Accesscode.3RT*" is returned and stored at a user-defined place, the software can be started. By clicking the <<Register>> button in the warning message (Figure 10), the registration window opens again. Press the <<Read the access code>> button, select the file Accesscode.3RT and open it. The access code is loaded (see Figure 11) and after pressing <<next>> the software is activated.

The window for unlocking of the program (Figure 10 and Figure 11) will not show up any more after the registration and it is possible to use the software on this computer for an unlimited period of time. The purchase of a new license is necessary for using the software on another computer. After pressing the << next>> button the main window of the program (Figure 12) opens up.

If the communication between the PC or the 3R TQC software and the MAGNATEST D SGP equipment and its software works correctly, the message "*System ready*" will appear in the status line (see above "TCP-IP-connection").

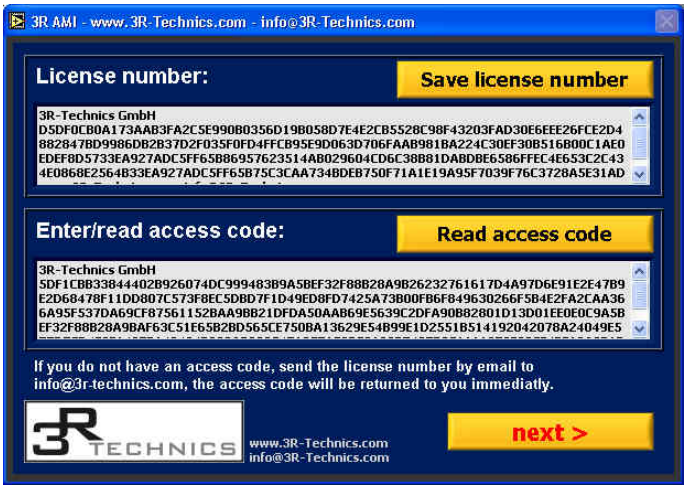

Figure 11: the access code loading

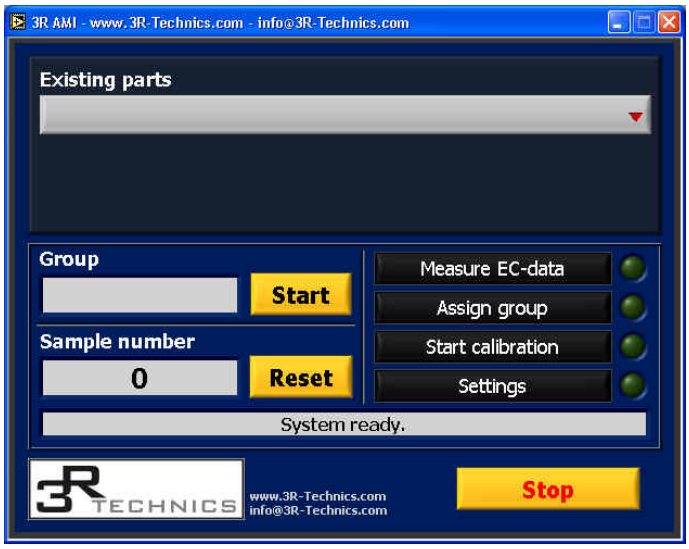

Figure 12: main window

Calibration

Process of calibration

1. Acquisition of the eddy-current values
2. Assignment of the groups/materials
3. Calibration of the 3R AMI software
4. Application of the 3R AMI software - identification of the groups/materials

Step 1 – Acquisition of the eddy-current values

Before the 3R AMI software can be used for material identification and separation, it is necessary to perform a calibration procedure. The calibration must be done for each dimension, for example by sheet metal for each thickness, by round material for each diameter and by pipes also for each wall thickness. By more complex geometries the calibration must be done for each part of the geometry or for each measuring point. For each dimension a name can be assigned freely, e.g. "100 x 7" as shown in Figure 14.

Figure 13: before the first input - input field inactive

Figure 14: product name input

Before the name can be entered, the <<Measure EC-data>> button and afterwards the button on the right side of the *New part* input field must be pressed (Figure 13). Thus the input field will be activated for entry of the name for a new product. No special characters can be used by the input of the name (Figure 11). The products for which a name was already assigned can be selected from the pull-down menu *Existing parts* (Figure 15).

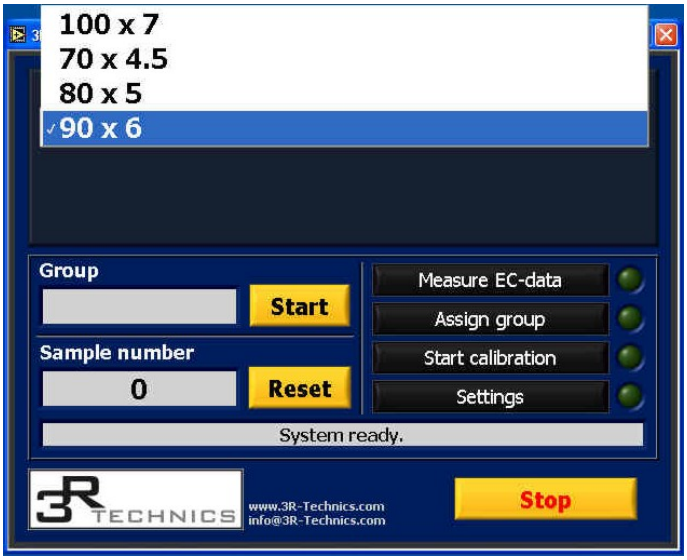

Figure 15: select an existing product

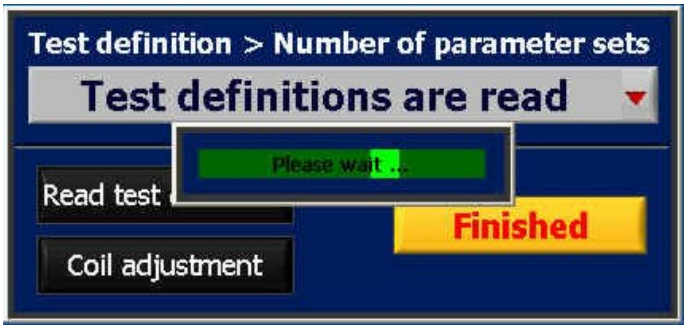

Figure 16: test definitions are read

The acquisition of the eddy-current values is activated by pressing the <<Start>> button, at the same time the name is stored (the name is not stored again if an existing part was chosen from the pull-down menu). Afterwards, the button on the right side of the input field *New part* can be pressed to deactivate the input field. It does not matter if this is not done after the first measurement of a material. During the acquisition of the eddy-current data the input field can either be active or inactive (see Figure 20).

Figure 17: the test definitions were read

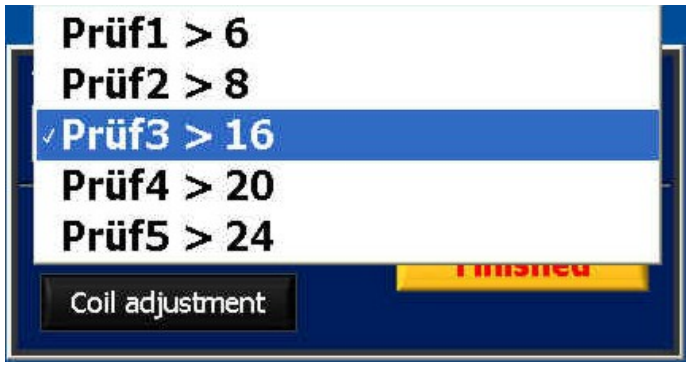

Figure 18: select the Test definition and do the coil adjustment

To simplify the operation, the current test definitions stored on the MAGNATEST D are read (see Figure 16, Figure 17 and Figure 18) and offered as options for the user. This occurs for a new part when the <<Start>> button is pressed. Reading the test definitions can take from a few seconds to a minute or two; it depends on the number of test definitions stored on the eddy-current device. By the selection of the test definition the maximum number of parameter sets, which is 24, has to be respected. The MAGNATEST D SGP works automatically in laboratory mode. The number written after ">" shows the number of parameter sets for a part. After a test definition was selected, the <<Finished>> button should be pressed to proceed. Immediately the coil adjustment is started automatically (see Figure 19) and takes a few seconds. Please follow the instructions on the screen. The button <<Read test definition>> should be pressed only if a new test definition which does not appear in the list was generated during the selection. Test definitions already assigned to a product in the 3R AMI software are displayed grey and cannot be selected. If this product is deleted (see menu <<Settings>>), this test definition can be used again.

Test definition > Number of parameter sets
3R AMI
Transmitter and receiver are adapted. Please insert part into the coil.
OK

Figure 19: the coil adjustment is started

Figure 20: the first sample for 100 x 7 was measured with the eddy-current system

Important

It is very important to mark the samples measured with the eddy-current system with the numbers <<Sample number>> given by the 3R AMI software. This number guarantees the correct assignment of the eddy-current data to the material. A wrong assignment can cause a wrong, sometimes even a useless calibration and must be done again. The numeration always begins with 1. The <<Reset>> button does not work during the calibration, only during the following testing; otherwise the unique allocation of the eddy-current values to the material description (steel grade, thermal treatment etc.) cannot be assured.

Step 2 - Assignment of the groups/materials

To be able to enter the steel grade and to assign the eddy-current values, the button <<Assign group>> should be pressed, and then the correct product name selected from the pull-down menu *Existing parts* (see Figure 21). After clicking the <<Start>> button, the input mask for the assignment appears (Figure 19). Before all other options and inputs (sample and group) are entered, the product name can still be changed here.

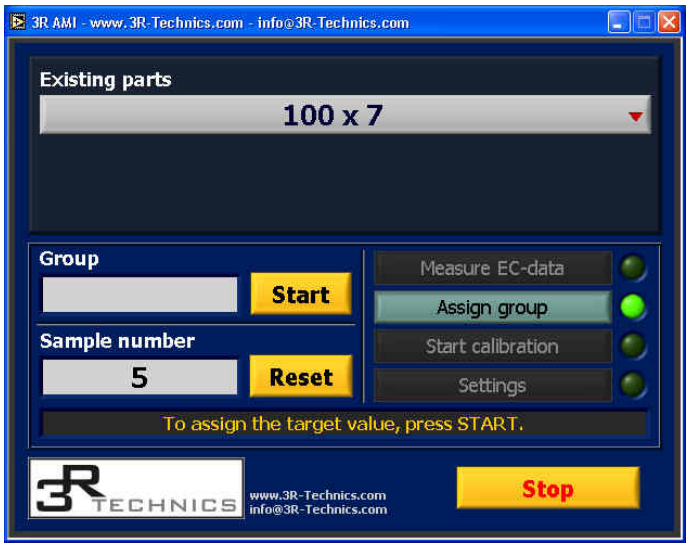

Figure 21: group assignment in the main menu

First the sample number in the pull-down menu *Sample* (see Figure 23) should be selected. It is not necessary to follow the order of the samples, but the group must be assigned to the correct sample number. For groups that are already used, the sample number can be selected from the pull-down menu.

By the first sample of a group the <<Add new group>> button must be pressed and the group name entered in the grey field below under the button.

If the inputs are correct, the <<Assign>> button can be pressed. Thus the data is stored and the entry for the sample number is deleted from the pull-down menu (see Figure 23). The assignment can be done consecutively for several samples. The procedure is terminated by clicking <<Finished>>.

Groups should, but do not have to be assigned to all eddy-current values. The calibration or pre-calibration can be started, if at least two samples were measured and assigned to two groups (steel grades) of one product (dimension). Thus measurements can be performed although not all calibration samples were entered. After the groups were assigned to the remaining samples, step 3 (see below) must be repeated, otherwise the data entered later will not influence the calibration and the reliability of the 3R AMI software.

Figure 22: group assignment - input mask

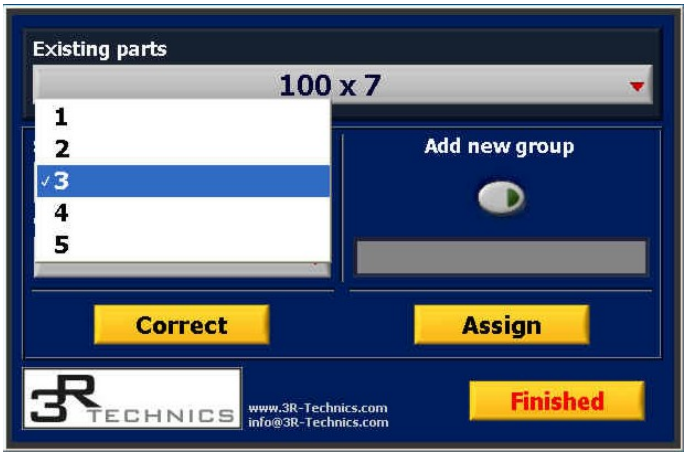

Figure 23: select the sample number

Figure 24: add a new group

Figure 25: select an already existing group

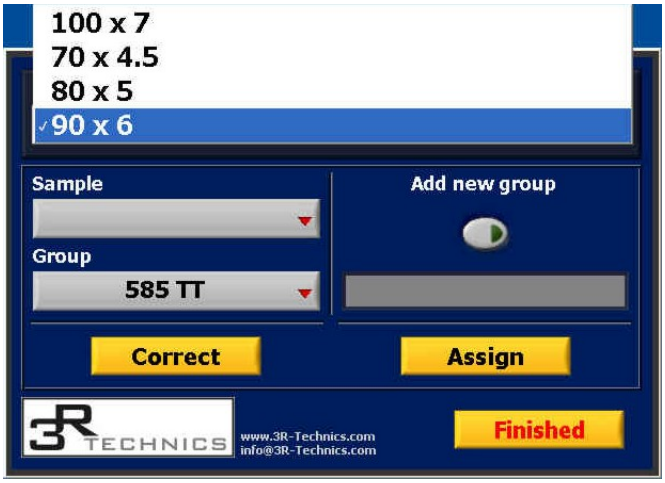

Figure 26: select a part (e.g. dimension)

Correction

A mismatched value can be corrected also later. In the <<Assign group>> menu the <<Correct >> button should be pressed to access the input mask for the correction of the assignment (see Figure 27 and Figure 28). In the pull-down menu *Correct sample* the sample numbers with the already assigned groups are shown. They can be selected again. Another existing group for the sample can be selected in the *New group* pull-down menu, or a new group can be entered pressing the *Add new group* button. The change must be confirmed with the <<Assign>> button. By pressing (deactivating) the <<Correct>> button again, the input mask for the group assignment will be displayed again.

If all values are entered and assigned, the input operation can be closed by pressing the <<Finished>> button. To activate the changes, step 3 (see below) must be executed too.

Figure 27: select a sample to be corrected

Figure 28: correct the assignment

Step 3 - Calibration of the 3R AMI Software

To compute the mathematical model of the interrelationship between the eddy-current values and the group/material, the <<Start calibration>> button must be pressed and the product name from the pull-down menu *Existing parts* selected. After pressing the <<Start>> button, the computation starts. This procedure can take up to a few minutes, depending on the number of calibration samples.

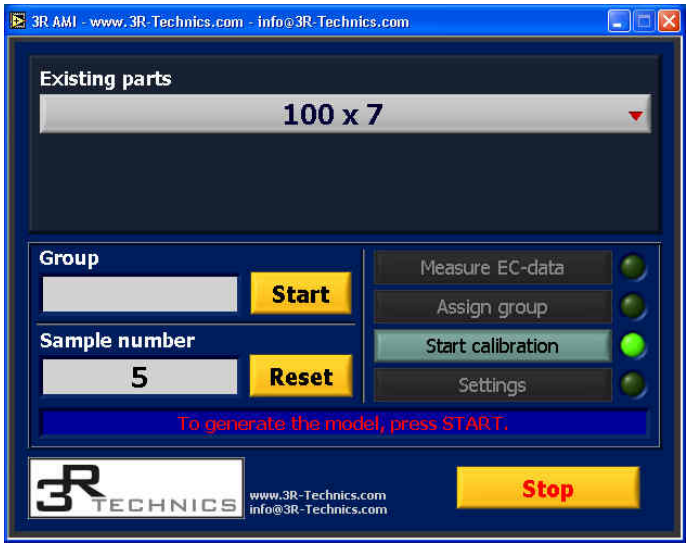

Figure 29: calibration button selected

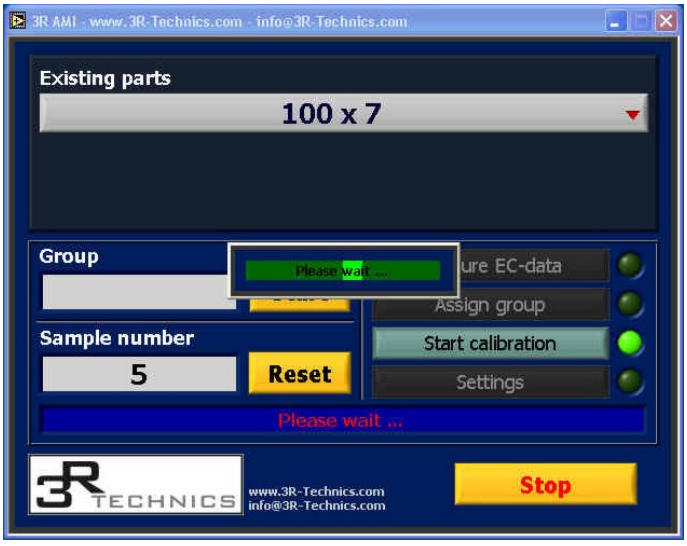

Figure 30: calibration after the start of the computation

The results of the calibration procedure are displayed in the << Results of the calibration >> menu.

Step 4 - Application of the 3R AMI software - identification of the groups/materials

After calibration the 3R AMI software can be used for the identification of the calibrated products.

Before the start of the measurements, the correct calibration for the product must be selected from the pull-down menu *Existing parts*, e.g. "101.60x8.38" (see Figure 31). The measurement is triggered by pressing the <<Start>> button. If a name was selected for the measurement, for which no calibration has been done yet, the message "*Model not existing!*" appears in the status line. The result of the measurement, the group/material of the tested part, is shown in the *Group* field on the left side of the <<Start>> button. The results, i.e. identified groups, will be compared with the group chosen in the <<Calibrated groups>> pull-down menu, and the output signal will be changed correspondingly (see Testresults-output in <<Settings>> <<Automatic trigger>>).

Figure 31: inspection

Important

To achieve sufficient sensitivity and reproducibility of a measurement and thus to ensure the correct identification of materials and also their correct classification it is necessary to adhere to the following minimum measurement conditions.

1) In case of bars, pipes as well as profiled materials it is necessary that at least 60% of the surface of the coil measuring hole by which measurements are performed is filled with the tested material. In case of pipes and hollow profiles it is sufficient to calculate the surface as if it was a full material. If the sensitivity is not sufficient, it is necessary to diminish the measuring coil so

that the filled surface is bigger and thus to increase the sensitivity of the measurement.

2) During a measurement no electric conductive and magnetic materials except for the object of measurement may be close to the measuring coil. This minimum distance is approx. 500 mm and depends on the coil used as well as the material measured. In a particular case contact us at info@3r-technics.com for further information

3) The minimum distance must also be kept from the edge of the tested material.

4) No disturbing electromagnetic fields may be nearby.

5) A reproducible position between the measuring coil and the tested material must be ensured and the maximum deviation may not exceed 0,5 mm.

Settings

By pressing <<Settings>> and then <<Start>> (see Figure 32), a menu with several adjustment and correction options is accessed. With regard to the number of options, this menu has two windows, between which one can switch by means of arrows (see Figure 33 and Figure 34).

Figure 32: access the settings menu

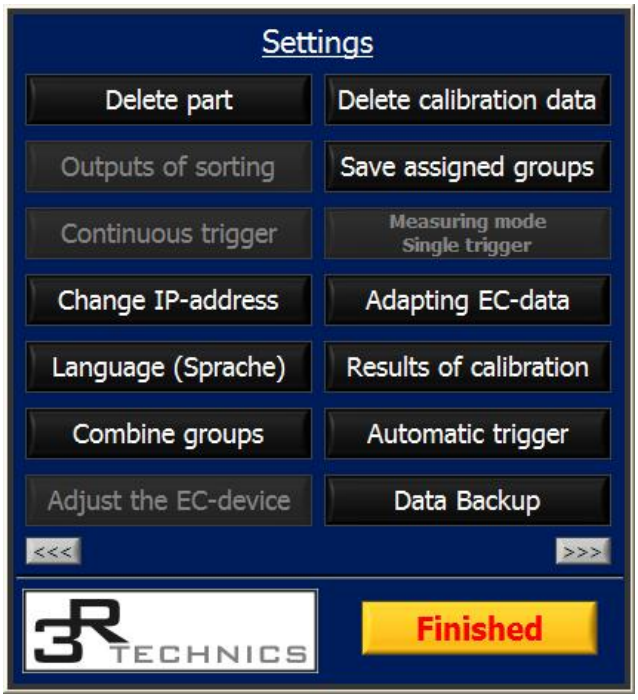

Figure 33: settings menu A

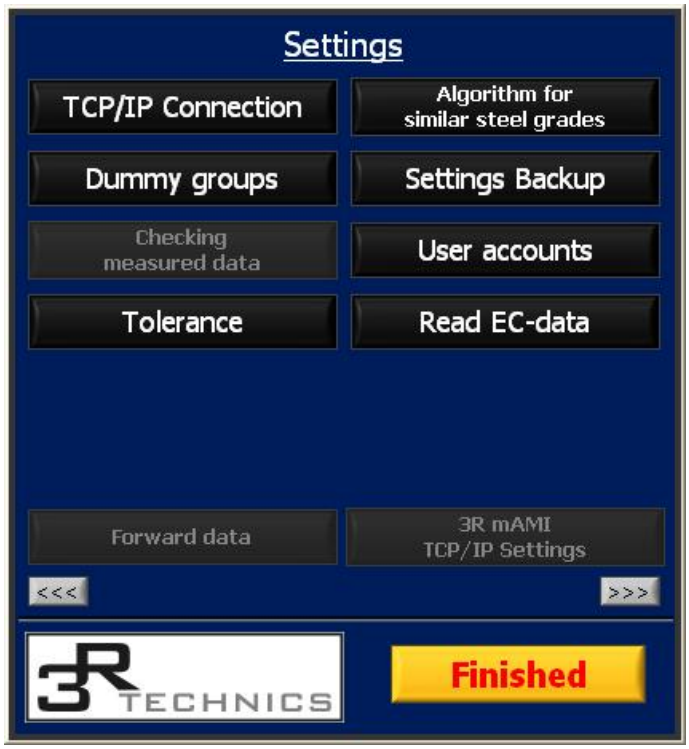

Figure 34: settings menu B

Deleting a part/product

After pressing the <<Delete part>> button, a part can be selected in the pull-down menu and deleted completely with all data. The corresponding test definition is then released. After selecting the product (see Figure 35), the deletion is started by pressing the <<Delete>> button. Then the last possibility to stop this process (see Figure 36) appears.

Figure 35: delete a product

Figure 36: delete a product - the last possibility to stop the deletion process

Deleting calibration data

It is possible to delete data from the calibration files if an error is detected. The error may occur during the input of the material name when a wrong group was assigned during the group assignment process or when it is not sure whether the eddy-current values of one or more samples were acquired correctly or not. In this case the data can be deleted from the calibration files. This can be done through the <<Settings>> menu, and then <<Delete calibration data>> (see Figure 33). After marking the sample number and the group, the deletion process is started by clicking <<Delete>> (see Figure 37). The last possibility to stop this deletion process will be offered (see Figure 38). The deletion effects the measurement only if a calibration is started after the deletion by pressing <<Start calibration>> and <<Start>> in the main menu (see Figure 29).

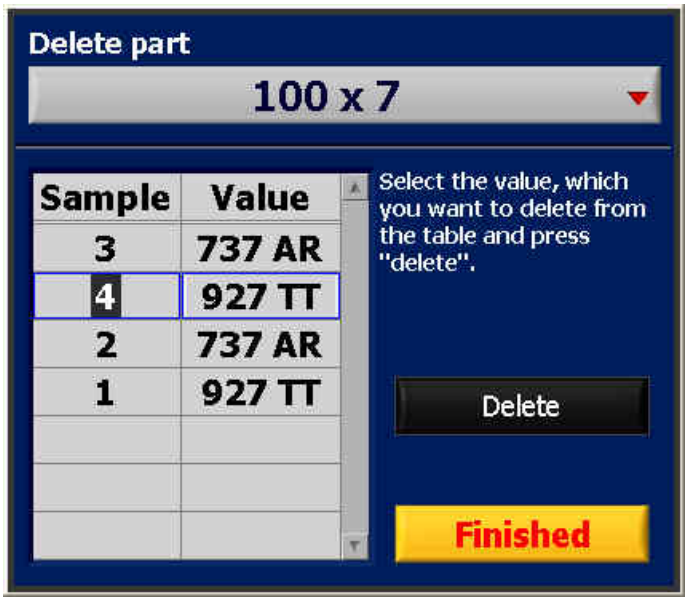

Figure 37: delete calibration data

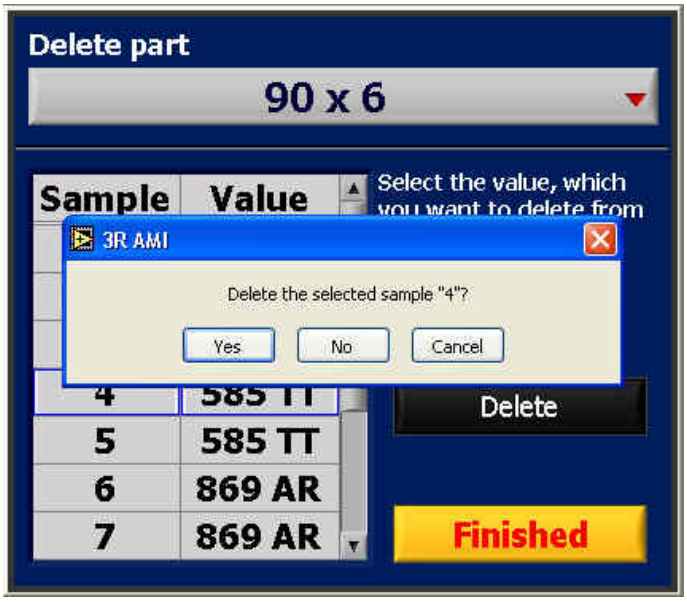

Figure 38: delete calibration data - the last possibility to stop the deletion process

Outputs of sorting

This function is designed for 3R TQC software.

Save assigned groups

The measured data of the last 30'000 parts can be exported by pressing the <<Save assigned groups>> button in the <<Settings>> menu (see Figure 33). Before exporting the data, the product must be selected in the *Existing parts* pull-down menu and confirmed by the <<Save>> button (see Figure 39). Then the path and the filename can be entered (see Figure 40). If the data for all requested products are exported, the menu can be closed by the <<Finished>> button. Exporting the data can take some time, depending on the number of samples.

Figure 39: save the assignments

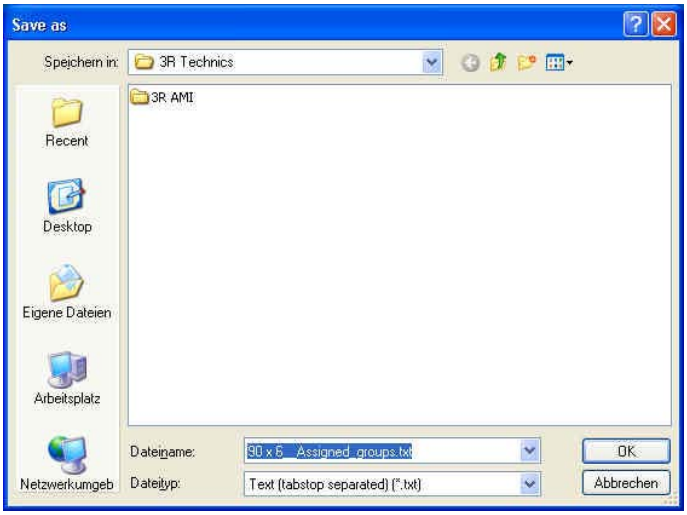

Figure 40: saving the assignments - entering the path

The sample-number is stored in the first column of the exported file. In the following N columns the eddy-current values are stored. N is 2 x the number of frequencies, since the real and imaginary part of the impedance are stored. In the last column the group that was computed on the basis of the eddy-current values is stored. If the eddy-current values lie outside the training (calibration) range "*Error measurement*" message will appear in the last column.

Continuous trigger

This function is designed for 3R TQC software.

Measuring mode / Single trigger

This function is designed for 3R TQC software.

Change of the IP-address

The IP address can be changed in the <<Settings>> menu (see Figure 33), and then <<Change IP Address>> option should be chosen (see Figure 41).

Figure 41: re-entering the IP-address of the MAGNATEST D device

Figure 42: entering the Localhost IP-address

After the confirmation of the IP-address by pressing the <<Finished>> button (see Figure 41), a connection with the MAGNATEST D device is established (see Figure 43). If everything is all right, the message "*System ready*", as shown in Figure 44, will appear. If the message "*No connection to the eddy current device.*" displayed in Figure 42 is shown, please check again the IP address, the firewall if used (e.g. the access authorizations) and the cables as well as the connectors.

Figure 43: connecting after a new IP address was entered

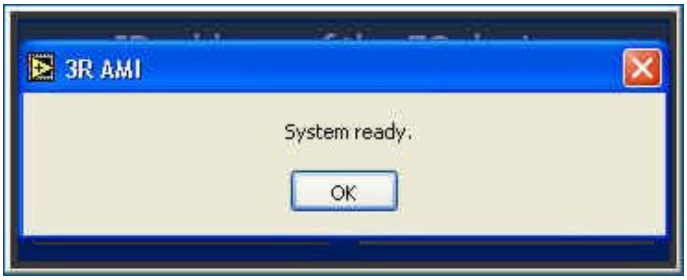

Figure 44: the connection is ok

Figure 45: error message after a new IP address was entered

Adapting the eddy-current data

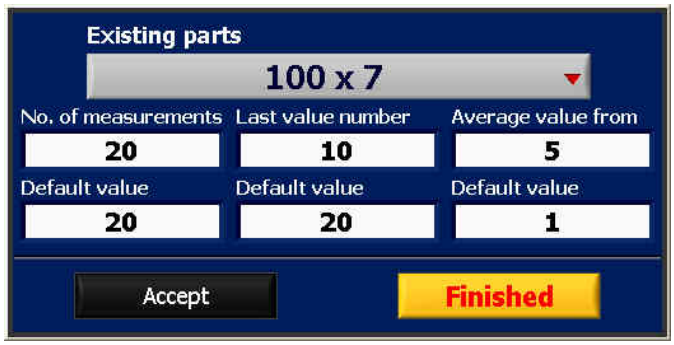

Figure 46: adapting the eddy-current data

In this menu it is defined how many measurements per sample are done, and how many measurements an average value is calculated consequently from. This average value is used for calibration. In the first phase for example, 20 measurements per sample can be done (*No. of measurements*). But the *Last value number* can be set to 10 and the number of measurements for the calculation of the average value *Average value from* to 5 (see Figure 46). Thus the average value is computed using the values numbers 6 to 10, and is used for training. If the settings of the three options in the *Default value* field are changed,

the changed settings are used also for the following parts. If the *No. of measurements* and the number of measurements used to calculate the average value are larger, a better stability can be expected for the measurements. During normal production it is probably not possible to do so many measurements per sample due to time constraints, but it should be a goal to do as many measurements as possible.

Language

With this function the language settings for the labelling of the control elements and the messages can be changed.

Figure 47: language settings

Results of the calibration

In this menu the calibration results are displayed and the tolerances for the calibration process set.

During the calibration procedure (computation of the mathematical model) the model can assign the samples different than the user. The reason can be a wrong assignment of the group in step 2 (e.g. steel grade), or an inaccurate acquisition of the eddy-current data in step 1. If one of these things happens, the calibration algorithm tries to increase the complexity of the model automatically in order to achieve a correct mapping (the same as set by the user). This is not reasonable if the calibration data is incorrect (the error occurred in step 1 or step 2). To avoid this, a tolerance was implemented in the software. This means the maximum allowable number of wrong assigned samples can be set by the user. To access the tolerance input mask (see Figure 32 and Figure 33) press <<Settings>> and then <<Results of calibration>>. The number of wrong assigned samples can be entered as an absolute number *Samples wrong – SP* or relative as a percentage *Samples wrong – SP [%]*.–The models can be changed by the switch below the *Relative* and *Absolute* signs in the input mask (Figure 48). The calibration runs as long as this criterion is not fulfilled or an error

message shows up. The number of mismatched samples will be indicated and marked red in the table, as shown in Figure 48. Thus measurement and type errors can be recognized quickly. In general, the number of wrong assigned samples should be zero.

Sample	Reference group	Actual group	T/F
1	585 TT	585 TT	True
2	585 TT	585 TT	True
3	869 AR	869 AR	True
4	585 TT	585 TT	True
5	585 TT	585 TT	True
6	869 AR	585 TT	False
7	869 AR	869 AR	True

Figure 48: settings - results of the calibration menu

Combine groups

In this menu groups can be combined. For example if three materials with different chemistries are heat treated differently but have similar or even identical mechanical properties, according to their mechanical properties they could form one group. However, with regard to their different chemistries and heat treatment they must be calibrated separately. In order to regard these materials as one when classifying materials, they can be combined in this menu. Nevertheless, they must be calibrated separately.

As an example, there are three materials (steel grades) with designations P110, L80 1 and TN150DW. Three groups have been calibrated <<Calibrated groups>> for these materials (see Figure 49) and you want to combine two materials, P110 a L80 1, into one group. Mark and shift them with the arrow one after another into <<Combined groups>> (see Figure 50). Before that, it is necessary to press and thus activate the green indicator. Hence, the input field <<New group>>, in which the name of the new combined group is entered, is activated as well (see Figure 51). By pressing the <<Accept>> button a new group is created which consists of the defined subgroups. At the same time, the input field <<New group>> is emptied and deactivated, the table <<Combined group>> is emptied, and the green indicator is also deactivated (see Figure 52).

Even though a combined group is defined, in this case “COMB1”, it does not have to be used at a check. It can be classified according to not combined groups. To be able to provide checking according to a combined group or groups it is necessary to activate the function by the <<Combination>> switch. All changes need to be confirmed by pressing the <<Accept>> button for each product <<Existing parts>> separately. When the necessary combined groups are created and the combination function is activated with the products where it is necessary, the work in this menu is finished by pressing the <<Finished>> button. Depending on the fact whether the function <<Combination>> is activated or deactivated, and whether combined groups are created for a product, the menu <<Calibrated groups>> is changed accordingly (see Figure 31).

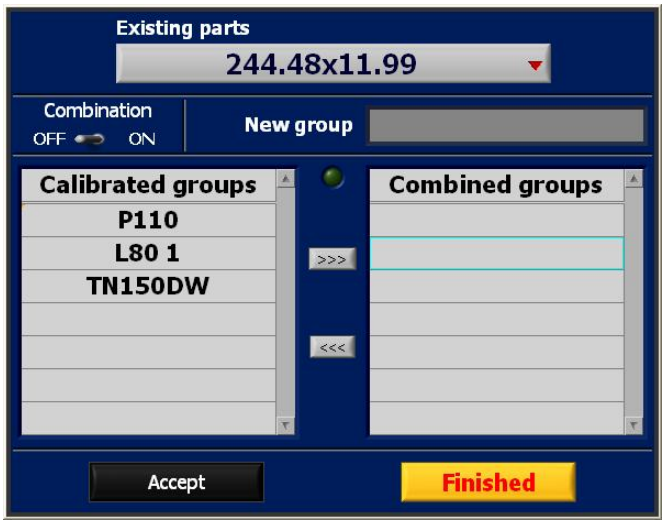

Figure 49: Menu – Combine groups

Figure 50: Menu – Combine groups – selection of groups

Figure 51: Menu – Combine groups – entering a name of a superior group

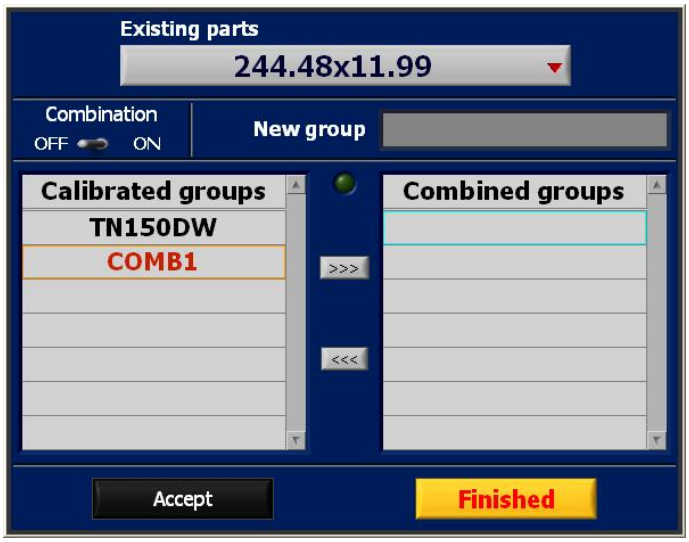

Figure 52: Menu – Combine groups – creation of a superior group

Automatic trigger

This menu enables to set external inputs and outputs. Before using external inputs and outputs it is necessary to activate and define them. They are activated or deactivated by the <<External input / output>> switch. The number of an input channel can be defined by <<Define input / channel>>. Through this input, channel measurements / checks can be triggered automatically, hence in the item <<Start test>> a channel number from 1 to 8 can be chosen and this channel then starts testing of products.

An output channel can also be determined by <<End test>> which will indicate the completion of the measurement / check. The number of a channel from 1 to 8 can be chosen in the same way as the input signal.

A test result can also be indicated via another output signal: <<Testresult>>. When choosing the number of a channel, the same channel number cannot be chosen in the <<End test>> at the same time. This number will be deactivated. To avoid the collision of signals the same is applied also vice versa.

In the picture the input starting signal number is 1, the signal-of-ending number is 2, and the results of measurement are indicated by the output signal 3.

The value of the output signal <<Testresult>> is 0 when the check result is identical with the selected group in the <<Calibrated groups>> menu (see Figure 31). In case it differs, the value is 1.

The electric connection and the description of input and output signals are described in the hardware manual.

Time delays of measurements against controlling signals can also be set in the <<Delay in milliseconds>> menu. There are two delay options; The first option is selected by <<Start->>. It works as follows: When the input signal <<Start test>> changes into 1 and the value in the input field <<Start->> is 1000, the measurement will be delayed by one second. If the value is set to 0, the measurement will be triggered without delays (immediately).

If several measurements are performed at one product consecutively (see <<Adapting the eddy-current data>>), delays between individual measurements <<Measuring->> can be set. This value is set to 0 as a standard in order to perform the measurements as quickly as possible.

Be careful about the synchronisation of the measurement with other stages of the production process when setting these values.

Figure 53: Menu – Automatic trigger

The settings can and also have to be done for each product/dimension <<Existing parts>> separately. It is necessary to confirm the settings by pressing the <<Accept>> button.

Adjust the EC-device

In the development stage: This function will become active in the next version.

Data Backup

In this menu, automatic backup of test results can be set (see Figure 54). The setting can be performed individually for each product/dimension or as a standard equally for all the products at once. If setting is done for some products individually and subsequently the setting is done as a standard <<Define as standard>>, then the settings of individually set products/dimensions remain unchanged. Backup can be activated and deactivated <<Backup>> and a directory where the data should be stored can also be chosen or created. The settings need to be confirmed through the <<Accept>> button. While saving the data, subdirectories will be created automatically according to products/parts.

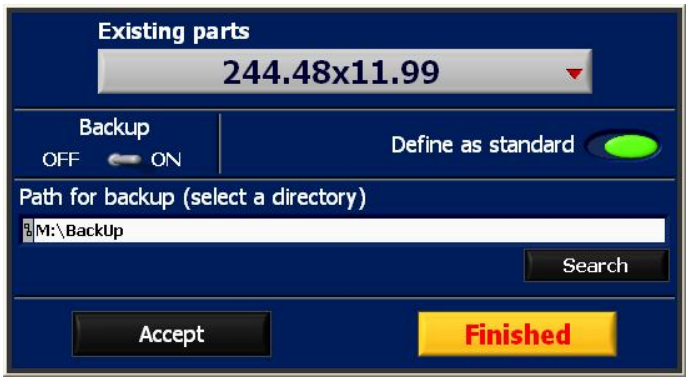

Figure 54: Menu – Data Backup

Test results will be recorded twice; once every 131 data, and once every 3001 data, or when changing a product/part as well as when switching off the software. The number of the recorded data is expressed in prime numbers in order to prevent and avoid the situation that both records will be performed at the same time. The following will be stored: 350 files each containing 131 data or lines and 700 files each containing 3001 lines. When this number is completed, the oldest file will be deleted.

Recorded data contain:

Sample number

Part

Frequency_1-X, Frequency_1-Y (the values – results of a measurement obtained through the eddy current method, i.e. real and imaginary component of every measured frequency), …

Test definition (see hardware instructions/manual),

Number of parameter sets

Number of measurements

Last_value_number – Sequence number of the last measured value used for creating a model

Average_value_from – Number of values used for the calculation of an average value

Searched group

Assigned group-Combined groups

Assigned group-Calibrated groups

Date/time

Sample number

TCP/IP Connection

Menu <<TCP/IP Connection>> enables to activate communication via Ethernet by means of TCP/IP protocol (see Figure 55). The Network port <<Network port>> is set here, too. Settings can be performed individually, thus each product/part <<Existing parts>> can be controlled either separately, e.g. from a different server, or it will be impossible to choose some products by means of remote access. One setting for all products can be performed at once by activating the <<Define as standard>> switch. The settings need to be confirmed by pressing the <<Accept>> button.

TCP/IP connection is used for the communication between the 3R AMI and 3R mAMI software. **3R mAMI software cannot be used without the activated connection as well as without the 3R AMI software.** TCP/IP connection is also used for communication between 3R TQC software and optional user's software that uses following commands which are sent via TCP/IP protocol.

Figure 55: TCP/IP Connection

This communication enables to control the software remotely through the following commands.

Command 1:

ExistingParts

Response 1:

ExistingParts:#88x11.9; #244x11.5; #101x11;

Command 2:

ActivateCalibratedPart=88.9x9.35

Response 2:

CalibratedPart=88.9x9.35

Command 3:

CalibratedParts

Response 3:

CalibratedParts:#88x11.9; #101x11;

Command 4:

Result

Response 4:

Result 1 88x11.5 5478 2014 100 91……

Command 5:

ExistingCalibratedGroups

Response 5:

CalibratedGroups:#AAA; #BBB; #CCC;

Command 6:

ActivateCalibratedGroup=AAA

Response 6:

CalibratedGroup=AAA

At the end of each data chain, there is hexadecimal 00.

Algorithm for similar steel grades

Through this menu, the algorithm enabling to classify similar parts or parts with similar values measured by the eddy current method better can be activated or deactivated. Settings can be performed individually or for all parts at once by activating the <<Define as standard>> switch. The settings must be confirmed by pressing <<Accept>> button.

Figure 56: Menu for switching on the algorithm for similar steel grades

Dummy groups

The access to this function is determined by the user's account and the access password. (see Figure 57).

After this function is activated the calibrated part can be tested even though only one group is calibrated within the product.

Figure 57: Menu – Dummy groups – access window

Figure 58: Menu – Dummy groups

If the <<Dummy group>> function is activated, two dummy groups are created along with the real one. The first group's values are lower; the second one's higher than those of the real group. The distance from the real group can be entered in % in the <<Distance>> field; and the scatter of dummy data in dummy group in % in the <<Scatter>> field.

Settings (see Figure 58) can be performed individually or for all parts at once by activating the <<Define as standard>> switch. The settings must be confirmed by pressing <<Accept>>. To finish the settings press <<Finished>>.

Settings Backup

This function enables to activate the backup of the settings (databases) on the Magnatast D device, 3R AMI software settings and calibration. This function can be activated by <<Settings Backup>> in the <Settings>> menu (see Figure 34). The backup is activated in the <<Setting Backup>> menu by <<Backup>> (see Figure 59 left upwards).

If the settings databases for the Magnatest D device and the 3R AMI software are on the same computer and on the same hard-disc, it means that the 3R AMI software is installed directly on the Magnatest D device, automatic search can be started by <<A_Search>> in <<Path to databases>>.The path to databases will be searched automatically. The search can take some time during which the notice *Please wait* will appear (see Figure 60). If the databases (Magnatest D settings) were found but they are incorrect, e.g. if the users have already done their own backup, it is possible to continue by pressing the <<Next>> button (see Figure 61). If the databases were not found (see Figure 62), what means they are saved on another hard-disc, please, select the right disc or its partition manually by <<Search>>.

The path for saving settings backups <<Path for backup>> must be selected manually through <<Search>>.Two folders will be created on the backup; one for the Magnatest D device settings backup and the other one for 3R AMI software calibration settings backup.

If the backup is activated it is performed in the predefined time during the calibration. Additional backup can be activated by <<Additional backups at>> <<Start of software>> at the start of the 3R AMI software, and by <<Finish of software>> on switching off of the software.

The settings must be confirmed by <<Accept>>. To finish the settings press <<Finished>>.

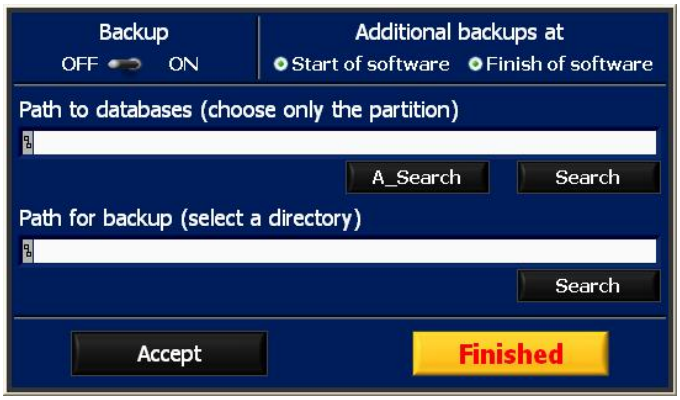

Figure 59: Settings Backup – not set / inactive

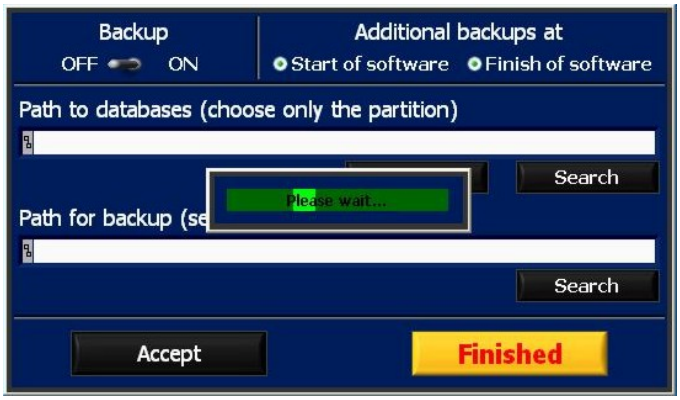

Figure 60: Settings Backup – searching the databases

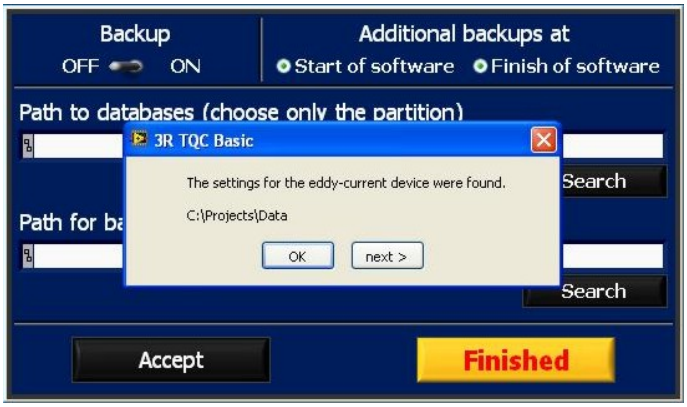

Figure 61: Settings Backup – databases were found

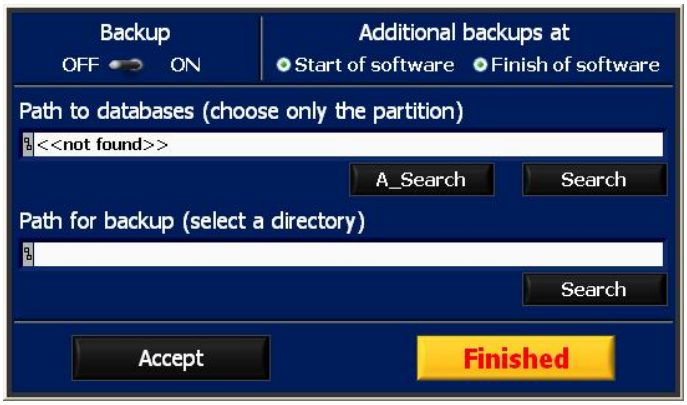

Figure 62: databases of the Magnatest D device settings were not found

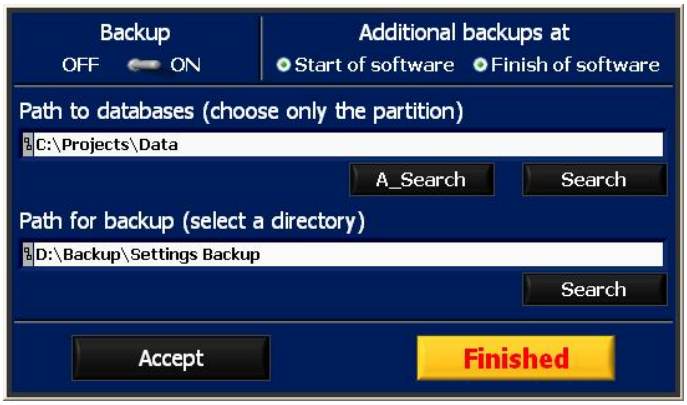

Figure 63: Settings Backup – example settings

Checking measured data

In the development stage: This function will become active in the next version.

User accounts

This menu enables to administrate the user access since several functions are not accessible to all users, e.g. <<Dummy groups>> or <<Tolerance>>. This function can be activated by <<User accounts>> in the <Settings>> menu (see Figure 34). The access to this menu is also determined by the user's name and password (see Figure 64). Functions are accessible according to user's rights – they can be either administrator or common. The user with administrator rights is allowed to create a new account, change the account type or delete the account

(see Figure 65, Figure 66, Figure 67 and Figure 68). Common user can only change the password. The menu is identical with the administrator's one (see Figure 67), but the option to change the account type is deactivated.

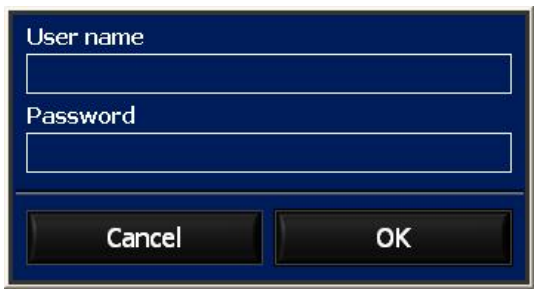

Figure 64: Access window

Figure 65: Administrator options

Figure 66: Creating a new account

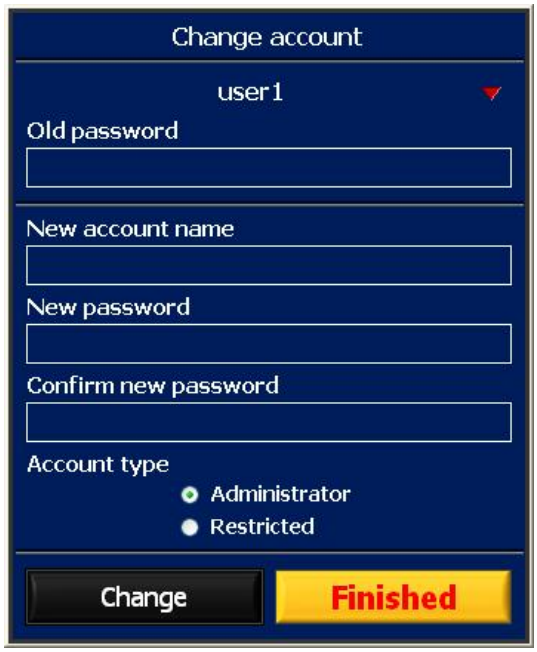

Figure 67: Changing the password and account type

Figure 68: Deleting an account

Tolerance

The access to this function is determined by the user's account and access password (see Figure 69). This function enables to change the percentage divergence of the testing sample measured data from the scatter of the calibration data, and at the same time the percentage of the measured data that must not suit the scatter to fulfil the condition for the appearance on the following alert <<Warning: This could be a group that was not trained.>>. If e.g. 5 frequencies are measured, i.e. 10 measured values are available (real and imaginary impedance), the message will not appear if the divergence of only 6 values is larger than 2%; if the divergence of 7 or more (70%) measured values is larger, the message will appear (see Figure 70).

Settings can be performed individually or for all parts at once by activating the <<Define as standard>> switch.

Figure 69: Tolerance field – access window

Figure 70: Tolerance field

Access to eddy-current data

This function enables to re-read the already measured data of testing samples again and to assign testing samples once again. Thus the calibration can be inspected without the necessity to carry out new measurements of the samples. This function can be activated by <<Read EC-data>> in the <Settings>> menu (see Figure 34). If this function is activated (see Figure 71) a new button will appear in the main menu (see Figure 72). After pressing the <<Start>> button a new window will be opened offering the option to choose a data file. In the “3R Technics” directory there is a subdirectory created for each product (part) in

which a "*Berechnete_Werte.txt*" file can be found. The file contains all samples tested for the given product (part). After choosing the right "*Berechnete_Werte.txt*" data file, groups will again be assigned to measured data and the new assignment will be stored in "*Berechnete_Werte_S.txt*" file. Various optional data can be read and re-counted, but their format and structure must be preserved, i.e. they must correspond with those in "*Berechnete_Werte.txt*" file.

Figure 71: Permission to access the reading of eddy-current data

Figure 72: Main menu – access to the reading of eddy-current data

Forward data – 3R mTQC

The TCP/IP configuration to forward data for postprocessing can be done in the <<Settings>> menu (see Figure 34) and then <<Forward data>> option (see Figure 73).

It the user wants to postprocess the data, the data forward must be activated by the <<TCP/IP Connektion>> switch. At the same time the IP-address of the target computer as well as the network port must be set correctly. The settings

must be confirmed by pressing the <<Accept>> button. To finish the configuration the button <<Finish>> should be pressed.

The forwarded data format is identical with the format used in Data Backup for each measuring place or device. At the beginning of each measured data group there is a column with measuring device name, and the data belonging to each measuring device are separated by tabulator.

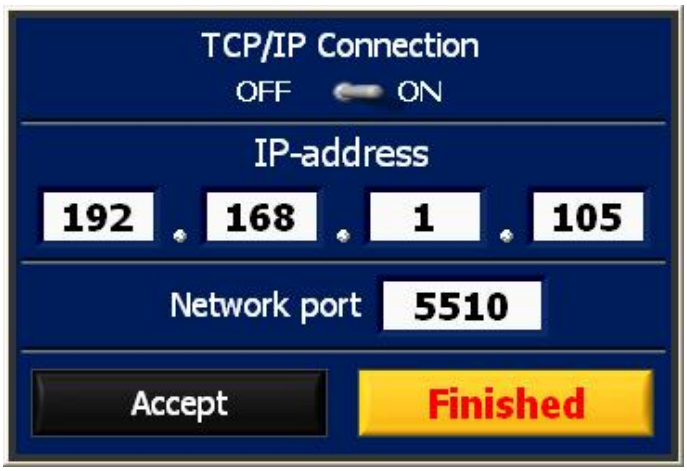

Figure 73: configuration of the TCP/IP connection for measured data forward

Change of the TCP/IP configuration – 3R mAMI

The TCP/IP configuration can be changed in the <<Settings>> menu (see Figure 34) and then in the <<3R mAMI TCP/IP Settings>> option (see Figure 74).

The name of the measuring device is entered into the table with the white background. If you e.g. have 3 measuring devices you want to measure with simultaneously by 3R mAMI, it is possible to assign each of them a name, e.g. Device 1, Device 2, etc. At the same time the IP-address and the port number must be entered. It is also necessary to define the disc or disc partition where the 3R Technics directory is stored. The 3R Technics directory is always located on the same disc or disc partition along with Windows® operating system. This disc or disc partition must be accessible for 3R mAMI software since 3R AMI software and 3R mAMI software share the data and directories of the 3R AMI software that are in the measuring device. Name, IP-Address, Port and disc must be entered and confirmed by pressing the <<Add>> button for each measuring device individually. After the confirmation the setting will appear in the table with the grey background. The measuring device settings can be deleted by selecting the device's name in the pull-down menu and pressing the <<Delete>> button (see Figure 75). All changes must be confirmed by pressing the <<Accept>> button. Work in this window is done by pressing the <<Finished>> button.

Figure 74: configuration of the TCP/IP-connection – add measuring device

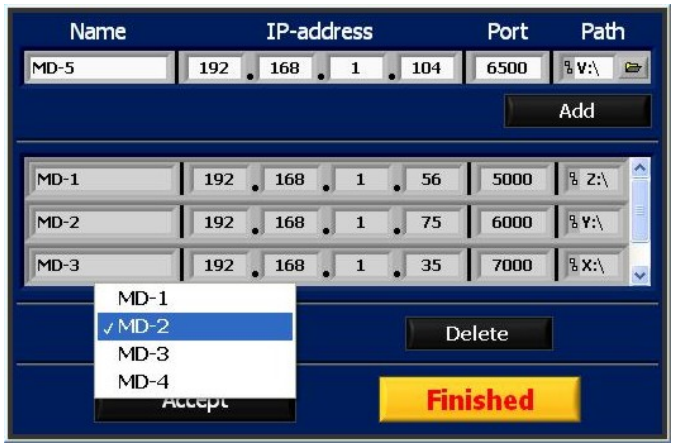

Figure 75: configuration of the TCP/IP-connection – delete measuring device

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